fore us a topographic map made by the U. S. Geological Survey, say ten years ago, and let it be supposed that this map, at the time it was made, was absolutely perfect. The map is supposed to show the contours, woods, streams, houses and other features that are usually represented on such a map. In the ten years since the map was made, it is reasonably certain that some changes have been made by the works of man. It is improbable that natural features would have changed, such as streams, woods and hills, during such a short period. We may assume that new roads have been made, old buildings torn down, or burned, and new ones erected, that wooded areas have been cleared, and that brush or young trees may now be on areas that were bare at the time the original survey was made. In order to test such a map and learn whether it was up to date, it would be necessary by the usual methods, to send a surveyor into the field to go over the area in great detail. Of course an inspection could be made of an area by driving over it, but many changes might be overlooked by this method of inspection.

How much simpler and more reliable it would be to send an airplane over the area in question and make a series of photographs. These photographs would show at a glance, the exact areas where changes in the features had occurred, and if the changes were not too complicated it is probable that we would be able to place the new features on the map directly from the photographs. The process would be to fit in the new features between unchanged old features, which of course would also be shown on the photographs.

PHOTOGRAPHIC PLATE SHOULD BE HORIZONTAL

In what has been said above, it has been assumed that the photographs have been made with the camera vertical, or, in other words, with the photographic film or plate in a horizontal position. It is only in this way that absolutely accurate photographs could be made. If the camera is tilted from the vertical at the instant the exposure is made, then there will be a distortion of the photograph so far as the map is concerned. If this tilting were known, then the photograph could be rectified and the features shown on the map with the same accuracy as if the plate had been horizontal at the time of the exposure.

It is hoped that methods will be developed for holding the camera in a vertical position at the time of exposure. I know of none now in use which is entirely satisfactory.

CONCLUSION

I may conclude that airplane surveying can be done now and it undoubtedly has a bright future. Much experimentation must be done, however, before the airplane can be used extensively in high-grade work.

I feel that the airplane can now furnish maps of a low order of accuracy so far as scale and position of features are concerned, which will be of considerable value in many branches of industry and commerce. They will undoubtedly be extensively used in unmapped areas in this and other countries in the very near future, for reconnoissance surveys and maps. But I hope they may be of great use in more accurate work.

I can pledge the Coast and Geodetic Survey, so far as its limited resources will allow, to take its part in making such tests by airplane as may be feasible in connection with surveying and mapping.

E. Lester Jones
U. S. Coast and Geodetic Survey

TRAINING IN SUGAR TECHNOLOGY IN HAWAII

Hawaii leads the world in her applications of science to the production of cane sugar. In no other country is the cultivation of cane so highly developed, the extraction so high, the chemical control so thorough, the mill processes so accurately coordinated. The entire organization of Hawaii's sugar industry is unparalleled for business efficiency and scientific control.

The experiment station of the Hawaiian Sugar Planters' Association is recognized throughout the world for the high quality of its investigational work. Its resources are

large, varied and unique. It has a large staff of trained research men, working in the various branches of sugar production.

The College of Hawaii has a standard four-year course in sugar technology. The College of Hawaii is the territorial college of agriculture and the mechanics arts. It corresponds in general status and organization to the state colleges and universities of the mainland. A number of its graduates are now actively engaged in the sngar industry.

The Courses in Sugar Technology are designed primarily for the student who, on leaving college, intends to enter into active service in some branch of the sugar industry. Although these courses, since they prepare for one particular industry, might be termed highly specialized, the importance of a sound training in general science has not been overlooked, the first two years being devoted largely to English, mathematics, physics and chemistry.

In the third and fourth years, enough special instruction in subjects pertaining directly to the sugar industry is given so that the man who completes this course should have sufficient technical understanding to prove of some immediate value in a subordinate position on a plantation, and yet not have his future progress hampered by an inadequate theoretical training.

The cane sugar industry, as carried on in the tropics, comprises in itself two quite distinct branches; the growing of cane, and its manufacture into sugar. Inasmuch as it would be extremely difficult, if not impossible, to give thorough instruction in both these branches, in four years, the courses in sugar technology are offered in two divisions.

Agricultural Division.—The first two years are identical with the course in agriculture. In the third year quantitative analysis and organic chemistry are taken up in addition to strictly agricultural topics, for the reason that sugar production is probably more dependent on chemistry than is any other branch of agriculture. Sugar analysis is also required, as familiarity with this work is often required of a field chemist. The fourth year allows a liberal amount of electives to those students who wish to specialize in some one subject. The lectures on cane sugar manufacture are required in this year, as it is desirable that the agriculturist have some knowledge of what happens to the cane after he has grown it.

Engineering Division.—The first year is identical with the course in engineering, while the second year differs only in the substitution of qualitative analysis for advanced mechanical drawing. Chemistry is continued in the third year, together with the most essential of the engineering subjects. Students in this division take sugar analysis and sugar manufacture together with those of the agricultural division.

During the summer vacation between the third and fourth years a minimum of eight weeks' work on one of the plantations, or in connection with the work of the experiment station of the Hawaiian Sugar Planters' Association, is required of students in both divisions. To obtain credit for this, a written report of work performed is required.

The second semester of the fourth year is devoted almost entirely to practical work. Arrangements are made whereby students either serve *a special apprenticeship* on a plantation where under direction they actually perform the manual labor required at the various stations of the mill and boiling house, or else they work as assistants to men carrying on the experimental field work of the experiment station.

Students are required during this apprenticeship to take careful notes of the equipment necessary, time required and labor involved in each operation, and will meet at stated times for discussion and comparison of notes, with a view toward fixing the relationship between the theoretical principles previously studied and their practical application.

COOPERATION BETWEEN COLLEGE AND STATION

An important agreement has been effected recently between the college and the sugar planters' station, the essential points of which are as follows:

1. The station accepts College of Hawaii students in sugar technology, for a 2–3-month period during the summer, or for a 4-month period during the winter and spring. These students serve in the capacity of assistants to the field research men of the station.

2. These student assistants are appointed by the college. The college receives reports from the students, but publication rests with the station director.

3. The station pays each student assistant $45.00 per month, and pays actual transportation expenses while traveling on station work.

4. The program of work for the student assistants is of a practical nature, but with due regard to the educational features involved. The president of the college cooperates in arranging the program.

Under the provisions of this agreement, College of Hawaii students in sugar technology have remarkable apportunities and facilities for first hand familiarity with Hawaii's sugar industry.

VAUGHAN MACCAUGHEY
COLLEGE OF HAWAII

SCIENTIFIC EVENTS

LOAN EXHIBITION OF EARLY SCIENTIFIC INSTRUMENTS AT OXFORD

THE Classical Association held its annual meeting at Oxford on May 16–17, and Sir William Osler delivered the presidential address on "The Old Humanity and the New Science." We learn from *Nature* that on May 16 Sir William opened a loan exhibition of instruments and manuscripts illustrating the scientific history of Oxford from the fourteenth to the eighteenth century. The greater part of the instruments now shown have never been publicly exhibited before. They have been unearthed in cupboards and corners of libraries of colleges and university departments. They are, for the most part, in their original state and of corresponding historic value.

The two earliest dated Persian and Moorish astrolabes, A.D. 987 and A.D. 1067, lent by Mr. Lewis Evans, form a worthy introduction to a wonderful series of instruments lent by Merton College. One of these is traditionally associated with Chaucer, and another of the Saphea type is considered by Mr. Gunther to have been the instrument left by Simon Bredon either to the college or to its great astronomer, Rede, early in the fourteenth century. The energies of these early astronomrs were largely directed to the preparation of astronomical tables, which had a wide circulation, and Oxford was regarded very much as Greenwich is now.

The later astronomical exhibits illustrate the instrumental equipment of the Earl of Orrery, who must have been acquainted with the first members of the Royal Society. Many of his instruments are still in the state in which he left them to Christ Church. His telescopes of 8 feet, 9 feet and 12 feet focal length, with many-draw vellum tubes and lignum vitæ lens-mounts by Marshall and Wilson, form a unique series.

There is also a Marshall microscope of 1603 in excellent condition, as well as some magnificent planetaria and other astronomical models by Rowley, the maker of the original Orrerv.

The slide-rule of 1654 in the South Kensington Museum, must now yield to an instrument lent by St. John's College, dated 1635. It is in the form of a brass disc 1 foot 6 inches in diameter engraved with Oughtred's circles of proportion. Would space permit, the series of volvelles or calculating discs showing the age of the moon from manuscripts of the fourteenth and fifteenth centuries, and some early surveying instruments, are worthy of more particular description, as well as many other treasures now shown to the public for the first time. A printed catalogue of the principal exhibits, prepared by Mr. Gunther, of Magdalen College, is published by the Clarendon Press.

A NATIONAL POLICY OF FOREST PRESERVATION

THE first of a series of regional conferences planned to consider special conditions in various sections of the country, so that a comprehensive national policy of forest preservation may be formed, was held May 20 in the United States Department of Agriculture. After for-